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Alberta Technology, Research and Telecommunications

1988-89 Annual Report

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Alberta Technology, Research and Telecommunications

1988-89 Annual Report

Alberta
TECHNOLOGY, RESEARCH
& TELECOMMUNICATIONS

Office of the Minister

403 Legislature Building, Edmonton, Alberta, Canada T5K 2B6 403/422-5982 Fax 403/422-6040

The Honourable Dr. David J. Carter
Speaker of the Legislative Assembly of Alberta
325 Legislature Building
Edmonton, Alberta
T5K 2B6

Dear Sir:

I have the honour to submit the Annual Report for the Department of Technology, Research and Telecommunications for the year ending March 31, 1989.

Respectfully submitted,

Fred A. Stewart
Minister

Alberta
TECHNOLOGY, RESEARCH
& TELECOMMUNICATIONS

Office of the Deputy Minister

12th Floor, Pacific Plaza, 10909 Jasper Avenue, Edmonton, Alberta T5J 3M8 403/422-0567 Direct Line 403/422-0063
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The Honourable Fred A. Stewart
Minister of Technology, Research and Telecommunications
403 Legislature Building
Edmonton, Alberta
T5K 2B6

Dear Mr. Stewart:

I have the honour to submit a report covering activities of the Department of Technology, Research and Telecommunications for the fiscal year ending March 31, 1989.

Respectfully submitted,

Ken H. G. Broadfoot
Deputy Minister

Minister's Message

At the forefront

At three years of age, the Department of Technology, Research and Telecommunications may still be considered a young organization. Certainly, the Department displays many of the attributes of youth, such as energy and vitality. These are the same attributes which have enabled the Department to play a considerable role in the Alberta Government's mandate of economic diversification. Indeed, as the Department matures, so too does Alberta's advanced technology industry.

The Department is committed to working with the private sector to create a vigorous advanced technology industry in the province. To date, 1,200 technology-intensive companies have developed, employing 50,000 people. Much of this growth is a result of the co-operation between the Government, the province's universities, the private sector and Alberta's extensive research and development infrastructure. With these partners, the Department has searched out new opportunities in research, development and commercialization of a myriad of technologies in strategic areas.

Alberta boasts many advanced technology success stories in areas such as electronics and microelectronics, telecommunications, biotechnology, computers and software, advanced manufacturing technologies and advanced materials. Alberta companies are proving that they can successfully compete in the global marketplace.

The importance of advanced technologies in our day-to-day lives continues to become more apparent to Albertans, thanks in part to the Department's activities and public awareness program. The continued co-operation and support of public institutions and the private sector, combined with the dedication of the Department, gives me the confidence to predict that Alberta will continue to be at the forefront of advanced technologies in Canada and around the world.

This report summarizes the 1988/89 activities of the Department and the Scientific Activities of the Government of Alberta as we strive to meet the exciting challenges and demands of global competition.

Fred A. Stewart
Minister

Mission Statement

The Department will promote the research, development and commercialization of science and technology, the application of new technology to existing and new industries, and the creation of new employment opportunities arising out of technology development within Alberta. It will ensure that public policy supports a high quality, affordable communications system for all Albertans, and work to create an awareness and understanding among Albertans of the economic, social and environmental benefits of advanced technologies.

The Minister is responsible to the Legislature for :

- the Alberta Research Council;
- Alberta Government Telephones;
- Alberta Educational Communications Corporation (ACCESS NETWORK); and
- the Alberta Heritage Foundation for Medical Research;

and liaises with the:

- Alberta Oil Sands Technology and Research Authority;
- Alberta Environmental Centre;
- Agricultural Research Council of Alberta;
- Alberta Foundation for Nursing Research; and

other provincial organizations undertaking research in the engineering, medical and natural sciences fields.

Department Goals

The goals of the Department are to:

- identify the priority advanced technology areas that will contribute to the growth and diversification of the Alberta economy;
- direct funds/resources for research, development and commercialization in those priority areas;
- ensure that resources available for technology development are applied in order to create favourable conditions for growth;
- commercialize technology successfully to maximize employment opportunities in Alberta and to enhance the competitive position of Alberta entrepreneurs;
- encourage a technology culture within the province which prompts broad participation by Albertans in the research, development, commercialization and utilization of advanced technologies;
- work with the federal and other provincial governments in defining and implementing the National Science Policy;
- emphasize priority advanced technology areas in conjunction with other provincial agencies, government jurisdictions, research institutes and industry to create cooperative initiatives aimed at exploiting the commercial benefits of technology development; and
- develop provincial policies and influence federal policies to ensure a high-quality, affordable communications system for all Albertans.

Department Strategies

The broad strategies of the Department include:

- developing "home grown" technology-intensive companies through the provision of start-up assistance, management and marketing support;
- identifying and establishing a "building block" infrastructure which will bridge the research interests of business, research institutions and universities;
- stimulating the commercialization of research and development through cooperative arrangements and programs applicable to business, universities, the general public and government laboratories;
- streamlining access to government programs which enhance the commercialization of science and technology;
- encouraging traditional industries to become more competitive and productive through advanced technologies, such as advanced manufacturing;
- working closely with the federal government in science and technology areas, with particular emphasis on obtaining an equitable share of federal science and technology expenditures;
- developing manpower training programs in conjunction with appropriate agencies to ensure that the Province can meet the human resources requirements for advanced technology development;
- improving the availability of risk capital;
- attracting investment by international technology companies which will result in the transfer of technology to Alberta in our priority development areas;
- establishing a communications program to build public understanding of Alberta's technology development opportunities and scientific achievements.

The Department has identified a number of advanced technology sectors in which Alberta may be competitive on a worldwide basis. These are:

- **electronics and microelectronics**
- **computers and software**
- **telecommunications**
- **medical and biological products**
- **advanced materials**
- **advanced manufacturing technologies**
- **environment-related technologies**

The Technology Commercialization Division is responsible for promoting these areas and assisting Alberta companies to develop new and innovative products which have local and international market potential.

The Division administers a $2 million Commercialization of Technology Program which provides financial assistance to private sector requests for the support of institutes, development of new products, commercialization of research, and feasibility studies. The program assisted 34 organizations during the fiscal year.

Electronics/Microelectronics Section

The Electronics/Microelectronics Section is responsible for assisting Alberta's electronics industry in developing new products and incorporating new technologies in electronics and microelectronics products. The industry is well supported by Alberta's advanced technology infrastructure which includes "building block" facilities such as the Electronics Test Centre, the Alberta Microelectronic Centre and the Alberta LASER Institute.

Initiatives of the past year include assisting the Alberta Microelectronics Centre in strategy and business development for future expansion of microelectronics fabrication facilities and a survey to be used to identify potential business opportunities, of manufactured products consumed by electronics and telecommunications industries.

As well, the Electronics/Microelectronics Section established business opportunities and procurements for the Triumf/Kaon accelerator project and the IRIS communications program and encouraged several corporate strategic alliances, joint ventures and partnerships for the benefit of Alberta industries.

Telecommunications Section

One of Alberta's technological strengths, due partly to the province's vast and varied geography, is an efficient and economical telecommunications system and an internationally-recognized telecommunications industry. This section assists companies develop telecommunications technology and products in the areas of voice, data, video, cellular radio, supervisory control and data acquisition (SCADA), avionics, satellite communications equipment, network management and local area network (LAN) systems.

Initiatives over the past year include helping the Alberta Telecommunications Research Centre attract federal funding and assisting Hughes Aerospace establish their national headquarters and the Hughes LANS division in Calgary.

Medical and Biological Sciences Section

The Medical and Biological Sciences Section assists with the development and commercialization of technologies that generate human health care products (drugs, vaccines, diagnostic agents) and agents used in new chemical, waste treatment, food processing and agricultural products. Biotechnology is a major stream of technology development within biomedical sciences.

The Department created the $2.3 million Medical Innovation Program to assist individuals and companies commercialize technologies in this area. The fund is administered by the Alberta Heritage Foundation for Medical Research.

Information Technologies Section

The Information Technologies Section is responsible for assisting Alberta's computer hardware, software and peripherals industry develop and commercialize new products and associated technologies. Developments of importance include high performance supercomputers, superminicomputers, parallel superminicomputers, engineering workstations and related applications software, often involving artificial intelligence, expert systems, computer-aided design, drafting and engineering.

This section also co-operates with computing sector associations, including the Alberta Society of Software Developers, the Canadian Information Processing Society, the Edmonton and Calgary Advanced Technology Associations, the Alberta Chapter of the Canadian Advanced Technology Association, the Information Technology Association of Canada and the Canadian Association of Data Processing Service Organizations.

Last year, the section began a needs evaluation for the province's high performance computing capabilities, with particular emphasis on the needs of universities.

Another initiative undertaken in the 1988-89 year was the award of a $7.5 million loan to Myrias Research Corporation of Edmonton to build a large-scale model of its SPS-2 Parallel Supercomputer for demonstration purposes.

Advanced Materials and Processes Section

Advanced materials technologies offer ways to achieve technological lead and market advantage for Alberta companies. The Advanced Materials and Processes Section assists existing and new Alberta industries such as oil and gas, microelectronics, telecommunications, biotechnology, and computer and software in the use of advanced materials and processes to increase market competitiveness.

The major project initiated during the 1988-89 year was called Westaim and led by Sherritt Gordon Ltd. This $140 million R&D project is intended to introduce new advanced materials products and to position Alberta as a major world player in advanced materials development and commercialization.

The section also encourages the development of a provincial advanced materials manufacturing sector that will complement our traditional resource-based industry sectors.

Section initiatives of the last year included the formation of a government, industry and university focus group concerned with advanced industrial materials.

The section also initiated key industry research projects with ARC, ALI and CFER, as well as many applied research projects for sector companies.

In addition, the section participated in the University of Alberta's seminar series on advanced industrial materials.

Another service provided by the Section was assistance to numerous sector companies in the preparation of business plans for new manufacturing initiatives.

Advanced Technologies/Manufacturing Section

The Advanced Technologies/Manufacturing Section concentrates on enhancing productivity and competitiveness of Alberta's existing manufacturing industries by applying automated processes. The Section provides assistance and advice to Alberta's manufacturers on the use of advanced manufacturing technologies such as computer-aided design, computer-aided manufacturing and robotics.

The section also focuses on the development of research parks and administers the Department's Technology Commercialization Program, which provides financial support to numerous advanced technology initiatives in the province.

The Section undertook a number of initiatives in the 1988-89 year including the official opening of a multi-tenant research facility in the Edmonton Research Park as well as the provision of funds for a multi-tenant research facility in the University of Calgary Research Park.

As well, the Section worked with the Consulting Engineers of Alberta to develop a seminar/workshop to identify technological opportunities for member companies. Additionally, work was done with the Alberta Research Council to develop and sponsor a Canada Space Program opportunities seminar for western Canadian companies.

During the course of the year, the section also provided support for small business incubator development and assisted numerous sector companies in developing business plans and searching out financing for new manufacturing initiatives.

Technology Transfer Section

Technology Transfer finds ways to commercialize inventions, technology know-how and technical information generated by agencies funded by the provincial government or private individuals. This includes working with technology transfer offices at the Universities of Alberta and Calgary.

This section also encourages provincially funded agencies to buy newly developed advanced technology products and processes through the First Purchase Program and encourages Alberta industries to adopt foreign technologies. The Section is also involved in importing technology inventions for use by Alberta's industries.

The initiatives of last year included the provision of significant financial support to the technology transfer offices at the Universities of Alberta and Calgary. This led to the privatization of the University of Calgary office now called University Technologies International.

The section assisted in the first purchases of advanced technology products by provincial agencies. This enabled Pelorus Navigation Systems to sell to Alberta Transportation.

In conjunction with the Licensing Executives Society and the Alberta Research Council, the Section sponsored technology transfer seminars in Edmonton and Calgary oriented toward the individual inventors. Over 50 inventors were assisted during the year.

As well, the Section helped stimulate the development of university industrial affiliates and encouraged the development of university spin-offs such as Celbiotronics and BRM Ltd.

Planning & Co-ordination Division

The Planning and Coordination Division provides research, advice and coordination in the ongoing development and administration of Alberta Government policy in both communications and science and technology.

The Division is responsible for long-term planning within the Department and assisting in the development of specific sectorial plans for advanced technology industries. It also provides technical, economic, financial and policy advice to support Departmental programs and other initiatives.

In addition, the Planning and Coordination Division provides support to the Minister in his responsibilities for the administration of the Alberta Research Council Act, Alberta Heritage Foundation for Medical Research Act, Alberta Educational Communications Corporation Act, and the Telecommunications Act.

The Division has administrative responsibility for the delivery of several programs including the Alberta-Heilongjiang Science and Technology Exchange Program and the Individual Line Service Program.

Telecommunications Policy

The Division was instrumental in the drafting of the new Telecommunications Act, which received Royal Assent on July 6, 1988. The Act effectively consolidated a number of telecommunications-related statutes as well as clarified a number of issues relating to the operating authority of Alberta Government Telephones (AGT), and the company's working relationship with the municipally-owned and regulated "edmonton telephones".

The Division was also involved in AGT's 1986 General Rate Application before the Alberta Public Utilities Board as well as a number of ongoing federal/provincial/territorial initiatives involving the development of a national telecommunications policy.

Broadcasting and Cable Television Policy

The Division continued to be active in providing policy advice on new federal government and industry initiatives in the fields of broadcasting and cable television. Special attention was given to reviewing the proposed new federal Broadcasting Act and particularly to those sections pertaining to cable television/telecommunications and educational broadcasting services. The Division also completed a survey of all broadcasting and broadcasting receiving undertakings in Alberta.

Distance Education

Through its membership on the Research Advisory Board of the Canadian Distance Learning Development Centre (CDLDC), the Department assisted in establishing policies and guidelines for the development and implementation of research activities in distance learning as well as evaluating research and product development proposals.

The Department assisted Junior Achievement of Northern Alberta in its successful offering of a ten-week course, Project Business, via satellite, television, telephone, and cable. The course was offered live to junior high school students at four different locations in northern Alberta.

The Department also participated on Alberta Education's two Distance Education committees: the Provincial Advisory Committee on Distance Education and Distance Learning Project North.

Science and Technology Policy

The federal government announced its four-year Networks of Centres of Excellence Program. The program is intended to encourage collaborative research between Canada's university and industry researchers in a number of strategic research areas, including advanced manufacturing and materials, biotechnology, computing software, electronics/remote sensing and telecommunications.

The Department acted as the Provincial Coordinator for the NCE Program, and established six provincial Ministerial Advisory Committees to advise the Minister on proposed projects in the six strategic areas above.

The Department was also involved in coordinating the Province's participation in a number of intergovernmental forums, including the September meeting of the Council of Science and Technology Ministers (CSTM), and the October meeting of the Western Ministers responsible for Science and Technology.

Science and Technology Exchange Program

The second full year of operation of the Science and Technology Exchange Program was completed. The program involves a yearly reciprocal exchange of up to 10 scientific personnel between Alberta and our sister province of Heilongjiang in the People's Republic of China. Last year, the program sponsored exchanges in the fields of biotechnology and computers, forestry transportation, electrical engineering, and remote sensing and land-related information systems.

RADARSAT Project

Division personnel finalized Alberta's participation in the RADARSAT project. RADARSAT is a Canadian-led international joint program to design, construct and operate Canada's first earth observation satellite system. Alberta will participate in policy development and planning guidance on the domestic aspects of the program in matters relating to the acquisition, processing and distribution of RADARSAT data. The satellite is presently under construction and is tentatively scheduled to be launched in 1994.

Industry and Statistical research

With ongoing development of the provincial database of technology-intensive enterprises (Altatech), the Division has been able to satisfy numerous data inquiries from a broad number of governmental agencies and private sector companies, as well as conduct in-depth research into the various characteristics of Alberta's advanced technology industries. During the reporting period, the Department also participated with Statistics Canada in conducting the annual survey of science and technology expenditures of the Alberta Government.

Individual Line Service Program

The past fiscal year was the first complete year of operation for the Individual Line Service Program (ILS). The Program began in September, 1987 when the first rural residents received an individual telephone line in place of a party-line, and represents the fulfillment of a commitment made by the Government to replace all multi-party lines in Alberta with individual line service.

The Program, which is scheduled for completion by June 1991, will provide more than 100,000 telephone subscribers throughout Alberta with private-line service. Over 75 per cent of the cost of individual line service is funded by the Government through the Alberta Heritage Savings Trust Fund.

As set by the Public Utilities Board, customers may choose to make a one-time payment to Alberta Government Telephones of $560 or equivalent monthly payments of $5. In keeping with the Government's commitment to provide this universal service at $450, subscribers will receive a rebate of $110.

The program also refunds monthly exchange circuit surcharges to rural customers who acquired private lines before the ILS program was begun.

The Department is responsible both for administering this program and for providing rebates to customers after their lines have been converted. As of March 31, 1989, 33,900 rural telephone subscribers had been converted to individual private-line service.

Trade and Economic Development Initiatives

The Division was involved in a number of interdepartmental initiatives, studies and reports dealing with provincial economic diversification strategies, achievements and related issues. With the implementation of the Canada/U.S. Free Trade Agreement, the Division was also involved in an ongoing assessment of the Agreement's impact on Alberta's advanced technology industries, and the ways in which industry could maximize the benefits of the Agreement.

Alberta Medical Innovation Program

Under the federal government's recently amended Patent Act, the federal government was required to pay $100 million to the provinces for medicine related research and development. Based on the $9.3 million accruing to Alberta, the Department established the Alberta Medical Innovation Program (MIP). This five-year program, which is to be administered by the Alberta Heritage Foundation for Medical Research (AHFMR), was established to assist Alberta businesses and entrepreneurs in prototype development, testing, and clinical trial of promising new drugs and medical devices, and will complement the existing technology transfer initiatives of the AHFMR.

Investment Development Division

The prime object of the Investment Development Division is to promote and facilitate investment in Alberta's advanced technology sectors.

The Division develops and reinforces an awareness in the Canadian and international business communities of the Alberta Government's commitment to research, development and commercialization of leading-edge technologies.

It encourages investment in advanced technology development by promoting Alberta's programs, facilities and institutions.

Potential investors are identified and introduced to opportunities and prospective joint venture partners in Alberta, and the Division assists entry into the Alberta business community.

Last year, the Division gained its first exposure on the eastern U.S. coast by participating in a major electronics show, Electro '88, held in Boston. On the other side of the U.S., in San Francisco, the Division participated in its first biotechnology exhibition, Biotech U.S.A.

The Division also promoted Alberta advanced technology investment opportunities by co-ordinating exhibitions in Anaheim, California and Toronto. Additional participation in these exhibitions came from Alberta companies, research institutions, educational institutions and municipal economic development authorities.

International delegations from Japan, West Germany, Switzerland, Australia and Thailand visited the province and were introduced to Alberta's advanced technology infrastructure.

Finally, in support of Alberta professional and scientific organizations, the department participated in exhibitions in Edmonton and Calgary to promote public awareness of Alberta's technological developments and accomplishments.

Financial Projects and Administration Division

Financial Projects and Administration provides analytical support, project appraisal and advice to the Department and Minister on financial aspects of projects funded by Technology, Research and Telecommunications. The Division provides legal and contract services to the Department, liaises with the Attorney General's Department, and is responsible for negotiating, drafting, and processing financial agreements and contracts. It also provides administrative support and financial advisory services to the Department.The Division establishes and maintains accounting records and procedures and prepares the annual Departmental budget. It monitors expenditures and contracts entered into by the Department with the private sector.

Corporate and Public Relations Division

Corporate and Public Relations manages the flow of information concerning the issues and activities relevant to the Department's mandate. It designs and delivers promotional materials required by other divisions of the Department, and co-ordinates information dissemination on behalf of the Minister and the Department. Corporate and Public Relations also assists advanced technology "building block" facilities, institutions and organizations to increase the understanding of the Province's science and technology achievements and ambitions. To help meet its goal of creating a "science culture" in Alberta, Corporate and Public Relations instituted a student awareness program aimed at creating a greater interest in careers in advanced technologies.

Human Resources Division

The Human Resources Division develops personnel systems and programs and provides consultant services to Departmental managers and staff. These programs consist of recruitment and selections, classification and compensation, employee relations, organizational design, human resources planning and pay and benefits administration.

Financial Statement

Budget Estimates and Expenditures Classified by Vote, Sub-Program and Element

Vote 1	**Development and Commercialization of Advanced Technologies**	**1988-90 Budget Estimates** (includes special warrants)	**Expenditures for the year ending March 31, 1989** (Unaudited)
1.0.1	Minister's Office	$219,303	$210,247
1.0.2	Deputy Minister's Office	177,528	182,174
1.0.3	Financial and Administrative Services	694,071	736,751
1.0.4	Research, Planning and Co-ordination	1,665,707	1,282,142
1.0.5	Technology Commercialization	937,654	855,085
1.0.6	Investment Development	413,870	394,778
1.0.7	Corporate and Public Relations	735,823	732,894
1.0.8	Human Resources	94,653	89,469
	TOTAL	$4,938,609	$4,483,540
Vote 2	**Financing of Technology and Research Project**		
2.1	Infrastructure Development and Support		
2.1.1	Biotechnology	-	-
2.1.2	Electronics/Microelectronics	$6,259,000	$6,259,000
2.1.3	Telecommunications/Information Services	902,150	793,814
2.1.4	Computer and Software	926,000	926,000
2.1.5	Advanced Manufacturing	-	-
2.1.6	Advanced Materials/Processes	1,000,000	1,000,000
2.1.7	Advanced Technology and Engineering Support	5,878,000	3,791,282
	Total Sub-Program	$14,965,150	12,770,096
2.2	Commercialization of Advanced Technologies		
2.2.1	Biotechnology	10,000,000	7,485,000
2.2.2	Electronics/Microelectronics	-	257,222
2.2.3	Telecommunications/Information Services	2,800,000	3,061,480
2.2.4	Computers and Software	-	4,240,469
2.2.5	Advanced Manufacturing	-	149,841
2.2.6	Advanced Material/Processes	400,000	1,112,561
2.2.7	Emerging Technologies	4,451,000	845,516
2.2.8	Medical Innovation	-	1,400,000
	Total Sub-program	17,651,000	18,552,089
	TOTAL	$32,616,150	$31,322,185

1. Introduction

The Provincial Government invests in science and technology that supports its public policy objectives in health improvement, environmental protection, industrial and social development, and the advancement of local scientific competence. Its science agenda is the sum of the programs and budgetary allocations of several departments and agencies. Technology, Research and Telecommunications, in co-operation with Statistics Canada, conducts an annual survey of the Government's science activities. This publication is a brief overview of the results of the 1988-89 survey.

On its own, this survey offers a series of indicators of provincial government expenditures, the allocation of those expenditures, human resources, and provincial priorities/objectives in the scientific arena. These provincial indicators can provide significant input to policy formulation and program evaluation when used in conjunction with the indicators generated from companion surveys (to be published at a later date), in particular those relating to the federal government, the private sector, universities, and private non-profit institutions.

The term "indicator" is used deliberately. Specifically, a number of problems exist with data relating to science activities, including: definitions, year-to-year consistency and measurement. Consequently, the reader should be alerted to an estimated confidence interval of ± 15 per cent. It should also be noted that surveys involving different respondents (ie. funders vs performers) can yield substantially different results. While Technology, Research and Telecommunications and Statistics Canada are working to resolve these limitations, and while the data does offer reasonable order of magnitude estimates, caution is urged in drawing conclusions which exceed the rigor of the data.

For more information, please contact the Director of Planning, Alberta Technology, Research and Telecommunications, 12th Floor, Pacific Plaza, 10909 Jasper Avenue, Edmonton, Alberta, T5J 3M8, (403) 422-0567.

II. Objectives of Science Expenditures

Industrial development, health and energy were the main targets of 1988-89 science expenditures. As described in Table 1, activities in fulfillment of these three objectives accounted for 74 per cent of the year's science spending, $173.1 million of 234.4 million.

As well, industrial development, health and energy were the focus of the Government's research and development agenda, absorbing $140.5 million (92%) of the $152.6 million spent on all R&D. Related science activities (RSA) accounted for 19 per cent of government spending in these three priorities, including such activities as demonstration projects, pilot process plants and technical studies.

The priority of industrial development was manufacturing, i.e. initiatives to encourage the production of new goods and services. Note that manufacturing R&D captured about 19 per cent of all science expenditures. Energy science dollars were directed toward fossil fuels projects. Research and development related to the exploration, extraction or refining of natural gas, crude oil and coal captured 89 per cent of the energy science expenditures and 15 per cent of the year's total science dollars. Expenditures related to health are predominantly basic medical research for the prevention and treatment of physical diseases. The Alberta Heritage Foundation for Medical Research provided $37.6 million of the total health related science funds.

The three main objectives depend on natural sciences and engineering capabilities, historically the dominant area of Alberta's science agenda. The social sciences commanded about 12.5 per cent of this year's science expenditures. As shown in Table 1, social development science activities were aimed at community enrichment, for example, the museums programs included under culture or urban and regional development initiatives. Also under the social development umbrella are government planning tools, such as studies on labour force demands and re-training programs and the creation of statistical forecasting models.

Table 1. Objectives of Science Expenditures of the Provincial Government in 1988-89

($ in '000s)

Objective	R&D	RSA	TOTAL $	%
Industrial & economic development	**63,306**	**23,207**	**86,513**	**37**
manufacturing	45,509	7,527	53,036	
agriculture	14,394	9,553	23,947	
forestry	2,816	1,250	-	
minerals	-	582	582	
fisheries	259	156	415	
other	328	4,139	4,467	
Health	**41,753**	**6,147**	**47,900**	**20**
Energy	**35,425**	**3,310**	**38,735**	**16.5**
fossil fuels	34,636	2,768	37,404	
conservation	148	5	153	
renewable resources	-	116	116	
other	641	421	1,062	
Social development	**6,154**	**17,879**	**24,033**	**10**
culture, sport, recreation	3,114	3,381	6,495	
education	491	5,702	6,193	
urban & regional studies	137	2,479	2,616	
human resources	160	1,017	1,177	
other	2,252	5,300	7,552	
Environmental issues	**2,842**	**20,221**	**23,063**	**9.8**
land information systems	800	15,000	15,800	
water	798	2,585	3,383	
air	553	889	1,442	
land	468	211	679	
other	223	1,536	1,759	
Transportation	**1,746**	**8,900**	**10,646**	**4.5**
Wildlife	**1,145**	**1,652**	**2,797**	**1.2**
Other	**252**	**505**	**757**	
TOTAL	152,623	81,821	234,444	

III. Major Funders and Performers

Various departments and agencies shape the government science agenda as performers and/or funders of research and related activities. Those with science expenditures exceeding $1 million are listed in Table 2. The year's science agenda was largely the product of TRT, AHFMR and AOSTRA which collectively accounted for 53 per cent of total expenditures. Note that these three organizations are essentially funders of research that is performed by the university and industry sectors.

Technology, Research and Telecommunications (TRT) was the main financier of manufacturing science and technology development, supplying $53 million toward that objective. The technology development was done by the universities and industry, and by the Alberta Research Council (ARC) of which TRT is the principal funder. TRT was the source for one out of three science dollars flowing to the private sector and one out of five dollars to the universities in 1988-89.

The Alberta Heritage Foundation for Medical Research (AHFMR) has been the mainstay of medical research funding since its creation in 1979. Its awards to university scientists in 1988-89 accounted for $2 out of $3 for university performed research. In relation to the government's objective of health improvement, AHFMR awards constituted about 80 per cent of the total expenditure. Other participants in the health agenda included the Environment ministry which used $3.4 million of its science budget for health related research and Health which contributed $5.7 million. Approximately $2 million for hospital-based medical research flowed through Health to the Alberta Cancer Board. Note that clinical research activities of hospitals were funded indirectly via the department's operating grants and are not included in this survey.

The Alberta Oil Sands Technology and Research Agency (AOSTRA), is the major source of government awards and contracts to industry for fossil fuels science and technology. About half of its 1988-89 research budget was delegated to the private sector. Alberta Energy shows a comparable reliance on industry. These two organizations provided $18.2 million or 37 per cent of the total government science dollars spent in the private sector.

The other departments and agencies listed in Table 2 are essentially performers, consuming two thirds to 90 per cent of their science budgets on intramural activities. In dollars, the largest science establishments within government were: Forestry, Lands & Wildlife, Agriculture, Culture & Multiculturalism, Transportation & Utilities and the Environmental Centre. The in-house science agendas of the first four departments were tied to their own program and policy needs. In contrast, the Environmental Centre is a service organization for other departments; in 1988-89, it addressed the research requirements of Agriculture, Forestry, Lands and Wildlife and Health.

In the aggregate, intramural expenditures of government absorbed 37 per cent of the year's science budget. Universities were the leading extramural performers, capturing 23 per cent of science expenditures; industry accounted for 21 per cent, while the ARC accounted for 13 per cent.

Table 2. Major Funders and/or Performers of the 1988-89 Provincial Government Science Agenda

($ in '000s)

Department or Agency	Total Science $	In-House	Industry	University	ARC	Other
TRT	53,000	482	15,504	11,301	23,650	40
AHFMR	37,623	1,376	-	33,313	-	2,934
AOSTRA	32,957	8,009	15,964	3,535	4,714	735
Forestry, Lands & Wildlife	20,092	15,407	5,421	314	822	128
Agriculture	20,776	14,830	1,112	2,330	723	1,781
Environmental Centre	11,126	10,143	800	103	75	5
Environment	6,556	3,749	1,569	30	174	1007
Transportation & Utilities	9,659	8,480	233	148	347	451
Health	5,788	2,414	438	1,311	179	1446
Culture & Multiculturalism	4,799	4,559	192	22	-	26
Energy	4,527	916	2,246	399	727	239
Municipal Affairs	3,922	3,263	532	-	-	127
Economic Dev. & Trade	3,478	2,490	930	20	-	38
Solicitor General	2,526	1,577	949	-	-	-
Advanced Education	2,176	492	-	1494	-	190
Education	2,139	1,370	258	190	5	316
Bureau of Statistics	1,932	1,606	326	-	-	-
Tourism	1,920	378	1,542	-	-	-
Career Dev. & Employment	1,588	1,132	182	29	-	245
Labour	1,339	918	421	-	-	-
Recreation & Parks	1,044	624	316	92	-	12
Others*	3,477	2,759	116	165	-	437
TOTAL	234,444	86,947	49,078	54,796	31,416	12,180

*Attorney General, AADAC, Consumer & Corporate Affairs, Family & Social Services, Occupational Health & Safety, Environment Council

IV. Human Resources

There is a human resources component to the intramural science expenditures. Salaries to scientists, technicians and administrative personnel accounted for $62.5 million (72 per cent) of intramural expenditures in 1988-89. Major employers of science personnel, those departments with 100 or more such employees, are shown in Table 3. As expected, the five departments with the largest in-house science budgets have the largest concentration of scientific talent. In 1988-89, they employed three out of four people of the government's science work force.

R&D personnel constituted 23 per cent of the science professionals, technicians and auxiliary staff. In-house R&D tends to be concentrated in the natural sciences and engineering fields, the science capabilities most prominent in environmental and agricultural research and paleontology. The vast majority (70 per cent) of science employees performed RSA. Their work spanned an array of information services such as technical/statistical surveys, mapping services, feasibility studies, testing and standards calibration. Throughout the 80's, the government's science work force has engaged predominantly in RSA. Staff associated with the administration of external science programs comprised 7 per cent of the government's science labour force.

Table 3. Science Personnel Employed by the Provincial Government, 1988-89

(In Full-Time Equivalents)

Department or Agency	R&D	RSA	AEP[1]	TOTAL
Agriculture	142	271	12	425
Culture & Multiculturalism	75	74	-	149
Environment[2]	100	207	7	314
Forestry, Lands & Wildlife	45	236	39	320
Transportation & Utilities	11	163	3	177
Other	51	354	67	472
TOTAL	424	1,305	128	1,857

[1] administration of external programs

[2] includes the Centre, Department and Council

V. Comparisons of Annual Expenditures

Scientific expenditures in 1988-89 were $8.4 million less than in 1987-88, a 3.5 per cent decrease. Major declines occurred in the science budgets of Environment (down $8.1 million) and AHFMR (down $23.5 million). These were offset by a change in reporting by Forestry, Lands & Wildlife which included land information services ($15.8 million) for the first time in its 1988-89 report. Historical revisions to the data will result in a larger annual decrease in science spending.

In a larger perspective, Government science expenditures have declined 30 per cent between 1986-87 and 1988-89, a loss of approximately $99 million. The majority of this change was caused by real decreases in the science activities of Environment, AHFMR and AOSTRA, a combined drain of about $76 million over the three years. Some of the decrease in science expenditures is attributed to changes in reporting by two departments, Culture & Multiculturalism and Health. Adjustments to their historical data will occur during the 1989-90 survey to provide more accurate overall comparisons.

Science expenditures have also decreased in relative terms. Table 4 tracks the percentage of government budgetary expenditures allocated to scientific activities during the 80's.

Table 4. Annual Science Expenditures as a Percentage of Provincial Government Budgetary Expenditures

Expenditures	1980-81	1982-83	1984-85	1986-87	1988-89
Science $ in '000s	119.9	212.8	276.7	333.4	234.4
Science % of all budgetary expenditures	2.1	2.3	3.0	3.1	2.1

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